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as before. The fiber was not injured by the discharge but could be saturated and used again and again. About the same number of discharges as had been employed with the exploded wires produced satisfactory results. For convenience in discussion and because of its character this new light source has been tentatively called the super spark.

An inspection of the calcium spectrum thus produced showed a striking enhancement of the spark lines of calcium over the arc lines indicating that a large proportion of the emitting atoms were ionized. For the purposes of comparison a table is inserted showing for the present work with the exploded wire and super-spark and for the work of other observers with various sources—the relative intensities of the H and K lines of calcium, a prominent spark doublet, and the line 4227, a strong arc line. The ratio of these intensities is, we believe, a fair index of the relative proportions of ionized and un-ionized emitting atoms in the source.

THE RELATIVE DEGREE OF IONIZATION OF CALCIUM IN DIFFERENT SOURCES

Source	Intensity of H and K	Intensity of 4227	Ratio of Intensities
King's electric furnace.....	55	1000	1:19
Crew & McCauley arc.....	400	500	4:5
Lockyer spark.....	500	400	5:4
Loving vacuum arc.....	20	8	5:2
Exploded wire.....	600	150	4:1
Super spark.....	700	70	10:1
High chromosphere of sun.....	72	8	9:1
Class B stars.....	7	1	7:1

This table indicates that there can be produced in the laboratory the same degree of ionization as is shown to exist in the high chromosphere of the sun or in the spectra of the early (or hot) type B stars. The super spark seems to give a more highly ionized source than any yet produced in the laboratory.

The results of an extended study soon to be published of the super spark spectra of calcium and other metals may be briefly summarized here. For the metals studied in the

groups one, two and three of the periodic table, an almost pure enhanced line or spark spectrum has been produced. As might be expected it has been impossible to get perfect ionization even in this source and the strongest lines due to the neutral atom still persist. A striking feature of the super spark is the amazingly small amount of material required to produce spectra. By use of a dilute solution of calcium chloride for example there is produced not only the calcium spectrum but also the spectrum of the other metals of the same group: Magnesium, barium, strontium, zinc and cadmium; and generally a few lines of other metals. These other metals could have been present only in minute amounts and yet their spectra rival in intensity that of the principal substance. Another striking characteristic is that practically only metallic lines are produced by the super spark,— the spectra of hydrogen, oxygen or of the acid radical of the salt used do not appear, and only the strongest air lines can be identified.

The super spark, it will be seen, gives a method by which a very powerful stimulus can be applied to any metal that can be obtained in the form of any of its partially soluble salts. It is not even necessary that the metal in question be the principal metallic constituent of the salt. Good results may be obtained for metals which appear only as minor impurities in the salt used.

R. A. SAWYER,
A. L. BECKER

PHYSICAL LABORATORY,
UNIVERSITY OF MICHIGAN,
August 11, 1921.

THE IOWA ACADEMY OF SCIENCE

THE thirty-fifth annual session of the Iowa Academy of Science was held at Simpson College, Indianola, on April 29 and 30. At the opening meeting on Friday afternoon President Knight gave his presidential address on "American science." The Academy divided into sections of botany, zoology, geology, and physics for the reading of papers, and at 5 o'clock adjourned for an enjoyable auto ride given by the Indianola Chamber of Commerce. At 6 o'clock the sections met for group dinners and at 8 o'clock Dr. J. Paul Goode of the University of Chicago, addressed the

Academy on "America as a world power." Following the address President and Mrs. Hillman of Simpson held a reception for the visitors.

On Saturday morning the sections concluded the reading of papers and the Iowa sections of the American Chemical Society and the Mathematical Association of America held their meetings. At the business meeting the constitution was revised to drop the classes of corresponding fellow and corresponding associate. Members are to be classed as honorary fellows, life fellows, fellows and associates. Six sections of the Academy are provided for and the chairmen of these, with the elected officers, constitute the executive committee. An editorial committee is provided for to assist the secretary in preparing manuscripts for publication. Officers were elected as follows: *President*, D. W. Morehouse, Drake University, Des Moines; *Vice-President*, R. B. Wylie, State University, Iowa City; *Secretary*, James H. Lees, Iowa Geological Survey, Des Moines; *Treasurer*, A. O. Thomas, State University; *Presidents of Sections*: *Botany*, R. B. Wylie; *Zoology*, Harry M. Kelly, Cornell College, Mount Vernon; *Geology*, A. C. Trowbridge, State University; *Physics*, L. P. Sieg, State University; *Chemistry*, P. A. Bond, State University; *Mathematics*, W. J. Rusk, Grinnell College, Grinnell.

The following program was presented:

CHEMISTRY

Further work in the study of free energy of aqueous solutions: J. N. PEARCE and H. B. HART.

The effect of relative positions of the hydroxide and amino radicals in the migration of acyl from nitrogen and oxygen: L. CHARLES RAIFORD and H. A. IDDLES.

A chemical study of dolomites: NICHOLAS KNIGHT.

Twenty-seven specimens were included in the investigation. They belonged to different parts of the United States and to a number of foreign countries. It was found that the term *dolomite* is rather loosely used, as the specimens ranged all the way from fairly typical dolomites to ordinary limestones. Indeed, some of the specimens proved to be quite pure sandstones.

A brief review of the various methods of producing dolomite artificially was included in the paper.

GEOLOGY

Three glacial tills at Ames, Iowa: JOHN E. SMITH. This illustrated paper treats of the char-

acter of these deposits and of their relations to each other. The observations were made in a large excavation opened to receive the foundation of Wesley Hall just south of the grounds of Iowa State College on Lincoln highway. At this place most of the Wisconsin till had been removed by erosion prior to the beginning of this work. A zone of red soil separates it near the top of the pit from the Kansan below. Beneath the Kansan which covers a rough, eroded surface, is a third till believed to be the Sub-Aftonian or Nebraskan.

Eolian deposits in Webster county, Iowa: JOHN E. SMITH. The location, distribution and origin of a deposit which overlies the Wisconsin till in this area is discussed in the paper. A typical section shows one foot or more of each of the following which are named in order of their occurrence from the surface downward: *Section*: (1) Clay, gray, with no pebbles. (2) Soil, a black zone of humus with few pebbles. (3) Subsoil, brown, with glacial pebbles. (4) Glacial till, unweathered. The principal question involved concerns the origin of number 1 of the section, which one authority holds to be free from glacial pebbles because of a postulated advanced stage of weathering.

The existing stage of erosion in the United States: ARTHUR C. TROWBRIDGE. Inspection of 398 topographic maps published by the U. S. Geological Survey since 1912, and representing 41 of the states of the Union, reveals no illustration of any considerable area of surface which has been reduced to old age of a cycle of erosion by the work of streams. Old valleys are fairly abundant but no general surface is found which can be said to have been baseleveled or even peneplaned. This is interpreted to mean that the present time was so closely preceded by uplift and enlargement of land that there has not since been time for streams to reduce the surface beyond maturity, or at best, beyond early old age. Either the Pleistocene period was too short to permit land uplifted in the latest Tertiary to be greatly reduced—an explanation which seems unlikely to the writer—or there has been Pleistocene or post-Pleistocene uplift.

Some north-south topographic profiles in the United States: ARTHUR C. TROWBRIDGE and JOHN T. LONSDALE. That part of the surface of North America which was not covered by the Pleistocene ice sheets was, during the glacial period, subject to the ordinary processes by which land is de-

graded or renewed. On the contrary not only was stream degradation repeatedly interrupted in the glaciated area, but the surface there was repeatedly eroded glacially, and as many times received glacial deposits. Thinking that these differences in Pleistocene history between the glaciated and unglaciated parts of the continent might have resulted in profiles notably discordant at or near the drift border, a series of meridional topographic profiles was drawn from the Canadian border to the Gulf of Mexico. The results are negative in that no topographic break is shown at the line separating the glaciated from the unglaciated area, but on the whole the surface near the drift border to the south is higher than that to the north. The paper consists of a presentation of these profiles and discussion of several possible interpretations of their meaning.

Interglacial volcanic ash: CHARLES KEYES. During the progress of extensive street grading in the city of Des Moines, recently, there was disclosed immediately under the Wisconsin till sheet, a white, claylike bed about a foot in thickness. It manifestly did not belong with the drift or the yellow loess beneath. Since the material was too incoherent to be true clay, and was finely gritty, it was examined under the microscope. It proved to be typical volcanic ash, composed of transparent, sharp-edged fragments of glass about one twentieth of a millimeter in average size. The thick loess deposit underneath is underlaid by the Kansan till. This occurrence probably fixes, within very narrow limits, the date of the volcanic outburst, and the age of similar ash beds reported in Nebraska, Colorado and Wyoming.

Erosion of high plateaux: CHARLES KEYES. The lofty, flat-topped mountain ranges of eastern Utah are usually treated as part of the great Cordilleran uplift. Curiously, they now appear both physiographically and tectonically to be wholly unrelated. Although the repeated uplifting and peneplanation which the Rockies have suffered are appreciably reflected in the Utah field the amount of erosion which the former has undergone enormously surpasses that of the latter. Notwithstanding the fact that both chains of mountains are characterized by remnantal summits, the latter seem to be nicely separated in point of time. On the one hand the summits of the Rockies appears to be ancient Comanchan peneplain now being exhumed as the Dakotan sandstone is being stripped off. On the other hand the *terre pleins* of the High Plateaux of Utah are re-

ferred to the regional planation of Miocene times. In the Cordilleran region these two horizons are stratigraphically separated by more than three miles of sediments. The Jurassic-Comanchan peneplain of the Rockies is strongly reflected so far east as Iowa and Minnesota; as is also the Miocene peneplain of Utah.

Crazing of mountain massifs: CHARLES KEYES. The central massif of the Sierra de los Cucaras, in Lower California, is a granitic type of rock not very unlike that of the Sierra Nevada. Its naturally blue-gray color darkens on exposure, thus bringing out in strong contrast the wonderful veining, which is white. The veining in the vertical walls of the mountain canyons has the appearance of normal jointing set on edge, but on a colossal scale, the cross-planes being filled with pegmatitic materials to a thickness of two to six feet. Towards the north end of the mountain range the titanic crazing is displayed in superb sections 1,500 feet high, in the famous Carrizo Gorge, near the United States boundary.

Some Pleistocene sections at Des Moines: JAMES H. LEES.

Some Carboniferous protozoa: EULA D. McEWAN.

The status of certain Rynchonellid Brachiopods from the Iowa Devonian: A. O. THOMAS and M. A. STAINBROOK. The *Rynchonella alta* Calvin from the upper Devonian beds at Bird Hill, Hackberry Grove, and elsewhere in Floyd and Cerro Gordo counties, has been much confused in the literature and in collections with a similar rynchonellid shell from the State Quarry beds near Solon. In most cases in the Iowa reports the Solon species has been called *Rhynchonella pugnax* or *Pugnax pugnax* (Martin). In some instances the two have been entered under the same specific name and in others the first has been made a varietal form of the second. A study of their internal structures by Mr. Stainbrook shows that each belongs to the genus *Pugnoides*. They are specifically distinct. The more robust but less acuminate State Quarry shell, with a variable number of plications on its fold and sinus, is made a new species, *Pugnoides solon*, and the Lime Creek species becomes *Pugnoides altus* (Calvin). Illustrations.

A Cephalopod from the Coal Measures at Mystic, Iowa: A. O. THOMAS. A fine specimen of the goniatite, *Gastrioceras excelsum* Meek, was recently collected by Mr. Ben H. Wilson, a member of the Academy. The specimen came from the Appa-

noose formation at Mystic, Iowa, and is said to have been taken from a shale just below a coal seam at a depth of fifty to sixty feet. The type of this species and one or two other examples came from the Pennsylvanian of Kansas; others are recorded from Arkansas; the specimen here reported is the first from Iowa. Illustrations.

Some Oligocene Brachiopods from the Island of Antigua, B. W. I.: A. O. THOMAS. In the Antigua limestone at Half Moon Bay, Antigua, there occurs an abundance of lepidocycline foraminifera, a number of sea-urchins, some corals, pelecypods, a few gastropods, and rarely some brachiopods belonging to the genera *Argyrotheca*, *Terebratulina*, and *Liothyridina*. They appear to be new species though the Liothyridinas are close to those reported by Guppy from Trinidad over fifty years ago. These small forms have added interest since very little is known about the brachiopods of the American Oligocene.

Note on a beaver tooth from the Pleistocene at Des Moines, Iowa: A. O. THOMAS. The specimen is an incomplete incisor tooth of the giant beaver, *Castoroides ohioensis* Foster. It was found by Mr. B. A. Wickham in gravels of uncertain age while making an excavation near the west city limits. This is the third locality record from Iowa, the others being Turin and Oakland. Illustration.

Some proboscidean remains found in Henry county, Iowa: H. E. JAQUES.

The loess fossils of western Tennessee: B. SHIMEK.

PHYSICS AND ASTRONOMY

A laboratory optical pyrometer: Notes on its design and operation: WM. SCHRIEVER.

(1) *Measurements of the amplitude of vibration of the diaphragm of the Hewlett tone generator.* (2) *Determination of the minimum audible intensity of tones of high frequency:* CLARENCE E. LANE.

A low frequency acoustic wave filter: G. W. STEWART.

(1) *The effect of drawing on the crystal structure of tungsten wires.* (2) *A note on Kater's reversible pendulum:* L. P. SIEG.

The coefficient of rigidity, and Young's modulus for hexagonal crystals of selenium: L. P. SIEG and R. F. MILLER.

The absorption of light passing through deep slits, as a function of the length and depth of the

slits and of the wave length of the light: L. P. SIEG and A. T. FANT.

The tactful analogy of stroboscopy: L. E. DODD. *Scattering of X-rays in carbon:* C. W. HEWLETT.

A new loud speaking telephone receiver: C. W. HEWLETT.

Hall effect in thin films: J. C. STEINBERG.

The Alpha lines in the "K" series tungsten spectrum: CHARLES CROFTUTT.

A note on Nova Cygni, No. 3: D. W. MOREHOUSE.

Review of solar observations at Alta, Iowa, during the past thirteen years, 1908-1920: DAVID E. HADDEN.

ZOOLOGY

A study of the nesting habits of the Baltimore oriole: H. E. JAQUES and KATHERINE GILMORE.

Nectarina in the United States: FRANK C. PELLETT.

Corn oil cake meal for growing and fattening pigs: JOHN M. EVVARD.

Notes on the mammals observed in Marshall county, Iowa: IRA N. GABRIELSON.

Bird banding and incidental studies: DAYTON STONER.

Burrows and burrowing habits of the common mole: A. V. ARLETON.

Some observations on certain Cladocera: FRANK A. STROMSTEN.

Alcohols as factors altering fatigue processes in frog muscle: FRANCIS M. BALDWIN.

Analysis of certain smooth muscle responses: B. M. HARRISON and FRANCIS M. BALDWIN.

Notes on the differential viability in Gambusia: S. W. GEISER. Author presents evidence to show that in the shipment of *Gambusia affinis*, the common mosquito fish, the males have a higher death rate than the females, both in winter and summer shipments. He shows by experiments that this higher death-rate is not due to warming of the water in the shipping can, but is owing to other causes. The male death-rate in warm weather shipments is much higher than that of those sent in cold weather; in the females, there is no corresponding increase in the death-rate. He combats the evidence brought forward (1921) by Barney and Anson to show a higher death-rate among the females in shipments of *Gambusia*.

The distribution of the European elm scale: ALBERT HARTZELL.

Further studies of the relative position of the maxima contractions of the amphibian muscle when subjected to the various ranges in temperature: R. L. PARKER.

*Cytology of the large nerve cells of the crayfish (*Cambarus*):* L. S. ROSS.

The readjustment of the peripheral lung motor mechanism after bilateral vagotomy: T. L. PATERSON.

A new Trematode parasite of the Unionidae: HARRY M. KELLY.

Two insect pests on clover: H. E. JAQUES.

Methods of teaching parasitology: HERBERT R. WERNER. (Posthumous.)

Insect parasitism with special reference to parasitic Diptera: IVAN L. RESSLER. This paper is a review of the important publications which have appeared since 1602, on insect parasitism, when the exit of the Hymenopterous parasite, *Apanteles glomeratus* L., from the common cabbage butterfly was observed. Parasitism as a factor in insect control is discussed as well as other natural agencies of control. The various families of the Diptera are classified with reference to their predatory or parasitic characteristics. The biology of the Tachinidae which is probably one of the best known of the parasitic Diptera, is discussed at length.

BOTANY

*Notes on the genus *Catherinea* in Iowa.—I:* LUCY M. CAVANAUGH. A discussion of variation in leaf-characters in this genus as represented in Iowa.

The use of common names for plants: B. SHIMEK. A presentation of some objections to the use of "common names" for plants.

A prairie grove in eastern Illinois: B. SHIMEK. A discussion of an isolated grove on the prairies at Royal, Illinois, and the evidence which it offers towards the solution of the problem of the treelessness of the prairies.

Some noteworthy fungi from South Carolina: GUY WEST WILSON.

Dr. Rudolph Gmelin and his collection of Minnesota, Wisconsin and Iowa plants: R. I. CRATTY. Dr. Gmelin lived for many years practicing his profession as a physician and surgeon at Elkader, Iowa, and other points, and a brief biographical sketch and a list of plants collected by him is presented.

Two additions to our list of Cruciferae: R. I. CRATTY. A brief paper on *Brassica juncea* (L.) Cossen, the Indian mustard, and *Lepidium perfoliatum* L., a recent emigrant from the old world.

A brief survey of economic botany: L. H. PAMMEL.

Studies in the germination of some woody plants: L. H. PAMMEL and CHARLOTTE M. KING.

Some wound responses of foliage leaves: ROBERT B. WYLIE.

Notes on phycomycetes: I. E. MELHUS.

A list of some of the phycomycetes in Iowa: J. M. RAEDER.

A key to the plant families of central Iowa: WINIFRED ELLSWORTH and HENRY S. CONARD.

Fossil plants and classification: HENRY S. CONARD.

A study of the vegetation of Austin Bluffs, near Colorado Springs, Colorado: T. J. FITZPATRICK. An intensive study was made of this area during the summer of 1920. As the location occupies an intermediate position between that of the plains on the one side and the mountains on the other its flora is an interesting one.

CHILD WELFARE

Research in the field of mental and physical development of children: B. T. BALDWIN and LORLE I. STECHER.

IOWA SECTION, MATHEMATICAL ASSOCIATION OF AMERICA

Correlation between mental tests and grades in mathematics of freshman engineering students: MARIA M. ROBERTS.

Playing with the sine and projection formulas: W. J. RUSK.

Certain summation formulas: JOHN F. REILLY.

Some properties of the function $w = \tanh z$: F. M. WEIDA.

Derived solutions of differential equations: M. E. GRABER.

The surface $z = \log_y x$: C. W. EMMONS.

Circles mutually tangent and tangent to concentric circles at specific points: C. W. WESTER.

A study of certain reports of the "National Committee on Mathematical Requirements": Committee Report. J. V. MCKELVEY, Chairman.

JAMES H. LEES,
Secretary